

PHARAO: the final stretch...

Ph.Laurent (SYRTE) , F.X. Esnault (CNES), D. Massonnet (CNES), Ch. Salomon (LKB), K.Gibble (Penn State)

The PHARAO clock is the primary frequency standard of the ACES payload that will be placed in orbit, on board the international space station (2025). PHARAO provides the frequency reference of the timescale, which will be compared with ground based clocks to fulfil the scientific objectives of the ACES mission. The frequency accuracy of PHARAO is expected to be 1.1×10^{-16} when the clock operates in space.

Ten years after the delivery of PHARAO, the final ground tests of the ACES payload have been achieved: the thermal and vibration qualification tests and the performance verification. PHARAO (installed in germany) was remotely operated by the CADMOS team (the ACES control center) in France. During this long period, the physical parameters and performance of PHARAO remained stable. On Earth, the frequency accuracy budget is 1.8×10^{-15} which has been checked through GNSS frequency comparisons with the SYRTE fountains. Due to the gravity, the dynamic of the cold cesium atoms strongly modifies the Ramsey interaction. That limits the frequency stability to $3.3 \times 10^{-13} \text{ t}^{-1/2}$ and some systematic frequency shifts cannot be deeply analyzed.

We will review the clock operation, the performance analysis and the scenario we will use in orbit to evaluate the systematic frequency shifts at the level of 10^{-16} . This evaluation will be realized after a scientific mission duration of two years.